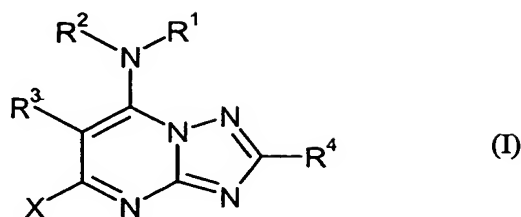


Claims

1. A triazolopyrimidine of the formula



in which

- 5 R^1 represents H, R^2 , optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted cycloalkyl or represents optionally substituted heterocyclyl,
- R^2 represents an organic radical which contains 3 to 13 carbon atoms and one or more silicon atoms and, if appropriate, 1 to 3 identical or different heteroatoms from the group consisting of oxygen, nitrogen and sulfur, and which is unsubstituted or
- 10 R^1 and R^2 together with the nitrogen atom to which they are attached represent an optionally substituted heterocyclic ring which contains one or more silicon atoms and/or is substituted by one or more radicals R^2 ,
- 15 R^3 represents optionally substituted aryl, optionally substituted heterocyclyl, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted cycloalkyl optionally substituted aralkyl, or optionally substituted amino group, optionally substituted (C₁-C₈)-alkoxy, optionally substituted (C₁-C₈)-alkylthio, optionally substituted (C₆-C₁₀)-aryloxy, optionally substituted (C₆-C₁₀)-arylthio, optionally substituted heterocyclyloxy, optionally substituted heterocyclyloxy, optionally substituted (C₆-C₁₀)-aryl-(C₁-C₄)-alkoxy, optionally substituted (C₆-C₁₀)-aryl-(C₁-C₄)-alkylthio, optionally substituted heterocyclyl-(C₁-C₄)-alkoxy, or optionally substituted heterocyclyl-(C₁-C₄)-alkylthio;
- 20 R^4 represents H, halogen, optionally halogen-substituted alkyl or optionally halogen-substituted cycloalkyl and
- 25

X represents halogen, cyano, optionally substituted alkyl, optionally substituted alkoxy or optionally substituted phenyl.

2. The triazolopyrimidine of the formula (I) as claimed in claim 1 where

R¹ represents H, or

5 R¹ represents a radical R², or

R¹ represents alkyl having 1 to 6 carbon atoms which may be mono- to pentasubstituted by identical or different substituents from the group consisting of halogen, cyano, hydroxy, alkoxy having 1 to 4 carbon atoms and cycloalkyl having 3 to 8 carbon atoms, or

10 R¹ represents alkenyl having 2 to 6 carbon atoms which may be mono- to trisubstituted by identical or different substituents from the group consisting of halogen, cyano, hydroxy, alkoxy having 1 to 4 carbon atoms and cycloalkyl having 3 to 8 carbon atoms, or

15 R¹ represents alkynyl having 3 to 6 carbon atoms which may be mono- to trisubstituted by identical or different substituents from the group consisting of halogen, cyano, alkoxy having 1 to 4 carbon atoms and cycloalkyl having 3 to 8 carbon atoms, or

20 R¹ represents cycloalkyl having 3 to 8 carbon atoms which may be mono- to trisubstituted by identical or different substituents from the group consisting of halogen and alkyl having 1 to 4 carbon atoms, or

R¹ represents saturated or unsaturated heterocyclyl having 3 to 8 ring members and 1 to 3 heteroatoms, such as nitrogen, oxygen and/or sulfur, where the heterocyclyl may be mono- or disubstituted by halogen, alkyl having 1 to 4 carbon atoms, cyano and/or cycloalkyl having 3 to 8 carbon atoms,

25 R² represents an aliphatic saturated or unsaturated group having 1 to 13 carbon atoms and one or more silicon atoms which optionally contains 1 to 3 identical or different heteroatoms from the group consisting of oxygen, sulfur and nitrogen and which is unsubstituted or substituted by 1 to 4 identical or different halogen atoms, or

- 5 R^1 and R^2 together with the nitrogen atom to which they are attached represent a saturated or unsaturated heterocyclic ring having 3 to 8 ring members which contains one or more silicon atoms and/or is substituted by one or more radicals R^2 , where the heterocycle may contain a further nitrogen, oxygen or sulfur atom as ring member and where the heterocycle may furthermore be substituted up to three times by fluorine, chlorine, bromine, alkyl having 1 to 4 carbon atoms and/or haloalkyl having 1 to 4 carbon atoms and 1 to 9 fluorine and/or chlorine atoms,
- 10 R^3 represents C_1 - C_{10} -alkyl, C_2 - C_{10} -alkenyl, C_2 - C_{10} -alkynyl, C_3 - C_8 -cycloalkyl, phenyl- C_1 - C_{10} -alkyl where R^3 is unsubstituted or partly or fully halogenated and/or optionally carries one to three radicals from the group R^X , or C_1 - C_{10} -halogenalkyl which optionally carries one to three radicals from the group R^X , and R^X represents cyano, nitro, hydroxy, C_1 - C_6 -alkyl, C_1 - C_6 -haloalkyl, C_3 - C_6 -cycloalkyl, C_1 - C_6 -alkoxy, C_1 - C_6 -haloalkoxy, C_1 - C_6 -alkylthio, C_1 - C_6 -halogenalkylthio, C_1 - C_6 -alkylsulfinyl, C_1 - C_6 -halogenalkylsulfinyl, C_1 - C_6 -alkylsulfonyl, C_1 - C_6 -halogenalkylsulfonyl, C_1 - C_6 -alkylamino, di- C_1 - C_6 -alkylamino, C_2 - C_6 -alkenyl, C_2 - C_6 -alkenyloxy, C_2 - C_6 -alkynyl, C_3 - C_6 -alkynyloxy and optionally halogenated oxy- C_1 - C_4 -alkyl- C_1 - C_4 -alkeneoxy, oxy- C_1 - C_4 -alkenyl- C_1 - C_4 -alkoxy, oxy- C_1 - C_4 -alkyl- C_1 - C_4 -alkyloxy,
- 15 R^3 represents phenyl which may be mono- to tetrasubstituted by identical or different substituents from the group consisting of
- 20 halogen, cyano, nitro, amino, hydroxy, formyl, carboxy, carbamoyl, thiocarbamoyl;
- in each case straight-chain or branched alkyl, alkoxy, alkylthio, alkylsulfinyl or alkylsulfonyl having in each case 1 to 6 carbon atoms;
- 25 in each case straight-chain or branched alkenyl or alkenyloxy having in each case 2 to 6 carbon atoms;
- in each case straight-chain or branched haloalkyl, haloalkoxy, haloalkylthio, haloalkylsulfinyl or haloalkylsulfonyl having in each case 1 to 6 carbon atoms and 1 to 13 identical or different halogen atoms;
- 30 in each case straight-chain or branched haloalkenyl or haloalkenyloxy having in each case 2 to 6 carbon atoms and 1 to 11 identical or different halogen atoms;

in each case straight-chain or branched alkylamino, dialkylamino, alkylcarbonyl, alkylcarbonyloxy, alkoxycarbonyl, alkylsulfonyloxy, hydroximinoalkyl or alkoximinoalkyl having in each case 1 to 6 carbon atoms in the individual alkyl moieties;

cycloalkyl having 3 to 8 carbon atoms;

5 2,3-attached 1,3-propanediyl, 1,4-butanediyl, methylenedioxy (-O-CH₂-O-) or 1,2-ethylenedioxy (-O-CH₂-CH₂-O-), where these radicals may be mono- or polysubstituted by identical or different substituents from the group consisting of halogen, alkyl having 1 to 4 carbon atoms and haloalkyl having 1 to 4 carbon atoms and 1 to 9 identical or different halogen atoms;

10 or

R³ represents saturated or unsaturated heterocyclyl having 3 to 8 ring members and 1 to 3 heteroatoms from the group consisting of nitrogen, oxygen and sulfur, where the heterocyclyl may be mono- or disubstituted by halogen, alkyl having 1 to 4 carbon atoms, alkoxy having 1 to 4 carbon atoms, alkylthio having 1 to 4 carbon atoms, haloalkoxy having 1 to 4 carbon atoms, haloalkylthio having 1 to 4 carbon atoms, cyano, nitro and/or cycloalkyl having 3 to 6 carbon atoms;

15

or

R³ represents C₁-C₈-alkylamino, C₂-C₈-alkenylamino, C₂-C₈-alkynylamino, di-C₁-C₈-alkylamino, di-C₂-C₈-alkenylamino, di-C₂-C₈-alkynylamino, C₂-C₈-alkenyl-(C₂-C₈)-alkynylamino, C₂-C₆-alkynyl-(C₁-C₈)-alkylamino, C₂-C₈-alkenyl-(C₁-C₈)-alkylamino, C₆-C₁₀-arylamino, C₆-C₁₀-aryl-(C₁-C₈)-alkylamino, C₆-C₁₀-aryl-(C₁-C₄)-alkyl-(C₁-C₈)-alkylamino, heterocyclyl-(C₁-C₈)-alkylamino or heterocyclyl-(C₁-C₄)-alkyl-(C₁-C₈)-alkylamino;

20

R⁴ represents H, halogen, (C₁-C₄)-alkyl which is unsubstituted or substituted by one or more halogen atoms, cyclopropyl which is unsubstituted or substituted by one or more halogen atoms, and

25

X represents fluorine, chlorine, bromine, CN, (C₁-C₄)-alkyl which is unsubstituted or substituted by one or more fluorine or chlorine atoms, (C₁-C₄)-alkoxy which is unsubstituted or substituted by one or more fluorine or chlorine atoms or (C₁-C₄)-alkylthio which is unsubstituted or substituted by one or more fluorine or chlorine atoms.

30

3. The triazolopyrimidine of the formula (I) as claimed in claim 1 or 2, where

R^1 represents hydrogen, methyl or ethyl, or

R^2 represents a group of the formula $Y^2-Si(O_mCH_3)(O_nCH_3)(O_pY^3)$,

where m, n and p independently of one another represent 0 or 1;

5 Y^2 represents a bond or alkanediyl, alkenediyl or alkynediyl, each of which is straight-chain or branched, has 1 to 6 or 2 to 6 carbon atoms, is optionally interrupted by one or two nonadjacent oxygen atoms and is unsubstituted or substituted by one to three identical or different halogen atoms;

10 Y^3 represents straight-chain or branched alkyl or alkenyl having 1 to 5 or 2 to 5 carbon atoms, optionally interrupted by an oxygen-nitrogen or sulfur atom and unsubstituted or substituted by 1 to 3 identical or different halogen atoms;

R^3 represents (C_1-C_8) -alkyl, (C_1-C_8) -cycloalkyl or benzyl or

R^3 represents phenyl which may be mono- to trisubstituted by identical or different substituents from the group consisting of

15 fluorine, chlorine, bromine, cyano, nitro, formyl, methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl, allyl, propargyl, methoxy, ethoxy, n- or i-propoxy, methylthio, ethylthio, n- or i-propylthio, methylsulfinyl, ethylsulfinyl, methylsulfonyl, ethylsulfonyl, allyloxy, propargyloxy, trifluoromethyl, trifluoroethyl, difluoromethoxy, trifluoromethoxy, difluorochloromethoxy, trifluoroethoxy, difluoromethylthio, difluorochloromethylthio, trifluoromethylthio, trifluoromethylsulfinyl, trifluoro-
20 methylsulfonyl, trichloroethynyloxy, trifluoroethynyloxy, chloroallyloxy, iodopropargyloxy, methylamino, ethylamino, n- or i-propylamino, dimethylamino, diethylamino, acetyl, propionyl, acetyloxy, methoxycarbonyl, ethoxycarbonyl, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, ethoximinomethyl,
25 methoximinoethyl, ethoximinoethyl, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

2,3-attached 1,3-propanediyl, 1,4-butanediyl, methylenedioxy $(-O-CH_2-O-)$ or 1,2-ethylenedioxy $(-O-CH_2-CH_2-O-)$, where these radicals may be mono- or polysubstituted by identical or different substituents from the group consisting of
30 fluorine, chlorine, methyl, ethyl, n-propyl, i-propyl and trifluoromethyl.

- 5 R^3 represents pyridyl which is attached in the 2- or 4-position and may be mono- to tetrasubstituted by identical or different substituents from the group consisting of fluorine, chlorine, bromine, cyano, nitro, methyl, ethyl, methoxy, methylthio, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, methoximinoethyl and trifluoromethyl, or
- 10 R^3 represents pyrimidyl which is attached in the 2- or 4-position and may be mono- to trisubstituted by identical or different substituents from the group consisting of fluorine, chlorine, bromine, cyano, nitro, methyl, ethyl, methoxy, methylthio, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, methoximinoethyl and trifluoromethyl, or
- 15 R^3 represents thienyl which is attached in the 2- or 3-position and may be mono- to trisubstituted by identical or different substituents from the group consisting of fluorine, chlorine, bromine, cyano, nitro, methyl, ethyl, methoxy, methylthio, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, methoximinoethyl and trifluoromethyl, or
- R^3 represents C_1 - C_8 -alkylamino or di- C_1 - C_8 -alkylamino, or
- 20 R^3 represents thiazolyl which is attached in the 2-, 4- or 5-position and may be mono- to trisubstituted by identical or different substituents from the group consisting of fluorine, chlorine, bromine, cyano, nitro, methyl, ethyl, methoxy, methylthio, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, methoximinoethyl and trifluoromethyl, or
- 25 R^3 represents N-piperidinyl, N-tetrazolyl, N-pyrazolyl, N-imidazolyl, N-1,2,4-triazolyl, N-pyrrolyl, or N-morpholinyl, each of which is unsubstituted or mono- or - if possible - polysubstituted by identical or different substituents from the group consisting of fluorine, chlorine, bromine, cyano, nitro, methyl, ethyl, methoxy, methylthio, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, methoximinoethyl and trifluoromethyl,
- 30 R^4 represents H, Cl, F, CH_3 , $-CH(CH_3)_2$ or cyclopropyl; and
- X represents F, Cl, CN, (C_1-C_4) -alkyl which is unsubstituted or substituted by one or more fluorine or chlorine atoms, OCH_3 or SCH_3 .

4. The triazolopyrimidine of the formula (I) as claimed in one or more of claims 1 to 3, where

- R¹ represents H;
- R² represents SiMe₃, SiMe₂Et, SiMe₂CHMe₂, SiMe₂CH₂CHMe₂, SiMe₂CH₂CMe₃, SiMe₂OCHMe₂, SiMe₂OCH₂CHMe₂, CH₂SiMe₃, CH₂SiMe₂Et, CH₂SiMe₂CHMe₂, CH₂SiMe₂CH₂CHMe, CH₂SiMe₂OMe, CH₂SiMe₂OCHMe₂, CH₂SiMe₂OCH₂CHMe₂, CHMeSiMe₃, CHMeSiMe₂OMe, (CH₂)₂SiMe₃, (CH₂)₂SiMe₂Et, (CH₂)₂SiMe₂CHMe₂, (CH₂)₂SiMe₂CMe₃, (CH₂)₂SiMe₂CH₂CHMe₂, (CH₂)₂SiMe₂CH₂CH₂Me, (CH₂)₂SiMe₂CH₂CMe₃, (CH₂)₂SiMe₂OCHMe₂, (CH₂)₂SiMe₂OCH₂CHMe₂, CHMeCH₂SiMe₃, CHMeCH₂SiMe₂Et, CHMeCH₂SiMe₂CH₂CH₂Me, CHMeCH₂SiMe₂CHMe₂, CHMeCH₂SiMe₂CMe₃, CHMeCH₂SiMe₂CH₂CHMe₂, CFMeCH₂SiMe₃, CHMeCH₂CH₂SiMe₂OMe, CHMeCH₂SiMe₂OCHMe₂, CHMeCH₂SiMe₂OCH₂CHMe₂, CH₂CHMeSiMe₃, CH₂CHMeSiMe₂Et, CH₂CHMeSiMe₂CHMe₂, CHMeCHMeSiMe₃, CMe₂CH₂SiMe₃, (CH₂)₃SiMe₃, (CH₂)₃SiMe₂Et, (CH₂)₃SiMe₂CHMe₂, (CH₂)₃SiMe₂CH₂CHMe₂, (CH₂)₃SiMe₂OMe, (CH₂)₃SiMe₂OCHMe₂, (CH₂)₃SiMe₂OCH₂CHMe₂, CHMeCH₂CH₂SiMe₃, CHMeCH₂CH₂SiMe₂Et, CHMeCH₂CH₂SiMe₂CHMe₂, CHMeCH₂CH₂SiMe₂OMe, CHMeCH₂CH₂SiMe₂OCHMe₂, CMe=CHSiMe₃, CH₂CH₂SiMe₂OMe, -C≡C-SiMe₃, -CH₂-C≡C-SiMe₃ or -CHMe-C≡C-SiMe₃;
- R³ represents (C₁-C₆)-alkyl, (C₃-6)-alkenyl, (C₃-C₆)-alkynyl, (C₃-C₈)-cycloalkyl, where R³ is unsubstituted or substituted by one or more fluorine or chlorine atoms,
- or
- R³ represents 2,4- or 2,6-disubstituted phenyl, or represents 2-substituted phenyl or represents 2,4,6-trisubstituted phenyl,
- R³ represents pyridyl which is attached in the 2- or 4-position and may be mono- to tetrasubstituted by identical or different substituents from the group consisting of fluorine, chlorine, bromine, cyano, methyl, ethyl, methoxy, methylthio, hydroximinomethyl, hydroximinoethyl, methoximinomethyl, methoximinoethyl and trifluoromethyl, or
- R³ represents pyrimidyl which is attached in the 4-position and may be mono- to trisubstituted by identical or different substituents from the group consisting of fluorine, chlorine, bromine, cyano, methyl, ethyl, methoxy, methylthio,

hydroximinomethyl, hydroximinoethyl, methoximinomethyl, methoximinoethyl and trifluoromethyl;

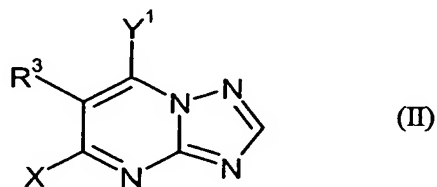
R^4 represents H, $-CH_3$, $-CH(CH_3)_2$, Cl or cyclopropyl,

and

5 X represents fluorine, chlorine, CN, (C_1-C_3) -alkyl, in particular CH_3 or (C_1-C_3) -haloalkyl, in particular CF_3 , OCH_3 , or SCH_3 .

5. A process for preparing a triazolopyrimidine of the formula (I) as claimed in one or more of claims 1 to 4, where

10 (a) halotriazolopyrimidines of the formula

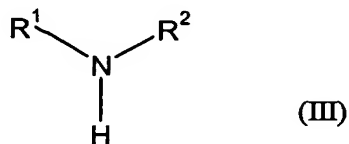


in which

R^3 and X are as defined above and

Y^1 represents halogen,

15 are reacted with amines of the formula



in which

R^1 and R^2 are as defined above,

if appropriate in the presence of a diluent, if appropriate in the presence of an acid acceptor and if appropriate in the presence of a catalyst.

6. A composition for controlling unwanted microorganisms, characterized in that it comprises at least one triazolopyrimidine of the formula (I) as claimed in one or more claims 1 to 4, in addition to extenders and/or surfactants.
- 5 7. The composition as claimed in claim 6, which comprises at least one further fungicidally or insecticidally active compound.
8. The use of triazolopyrimidines of the formula (I) as claimed in one or more of claims 1 to 4 for controlling unwanted microorganisms.
9. A method for controlling unwanted microorganisms, characterized in that
10 triazolopyrimidines of the formula (I) as claimed in one or more of claims 1 to 4 are applied to the unwanted microorganisms and/or their habitat.
10. A method for preparing compositions for controlling unwanted microorganisms, characterized in that triazolopyrimidines of the formula (I) as claimed in one or more of claims 1 to 4 are mixed with extenders and/or surfactants.